Climate Justice & Labor Rights

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Introduction

In the second half of 2023, generative AI is dominating headlines. Policymakers, technologists, and activists are all grappling with its potential implications for communities and the planet. Integrating LLMs (large language models) into search engines may multiply the carbon emissions associated with each search by as much as five times. At a moment when climate change is already having catastrophic effects and the final 2023 IPCC report indicates that the current gap between net zero pledges and global GHG (greenhouse gas) emissions reductions means that it is highly likely that the earth's warming will exceed 1.5 degrees Celsius by the end of the century, the current hype around AI seems especially dangerous. Simultaneously, generative AI poses risks to workers in a number of fields, continuing a long trend of labor exploitation through apparent automation. Despite the perception that generative AI will automate jobs and render knowledge workers obsolete, research shows time and time again that humans, and globally dispersed, poorly paid annotators, are still operating behind AI. A difficult to parse supply chain of ecological extraction and labor exploitation facilitates the apparent magic of AI.

In this report, I examine the intersection of these two issues in AI: climate and labor. Part I focuses on the relationship between AI labor supply chains and internal corporate workplace practices and hierarchies. How are researchers and developers grappling with the complex problem of calculating carbon footprints in machine learning while assessing potential risks and impacts to marginalized communities? In an industry dominated by OKRs (objectives and key results) and quantifiable success metrics, the importance of carbon accounting or other data collection and analysis tends to take precedence over other forms of action. In other words, even with the introduction of regulations demanding that companies measure and report their carbon emissions, it is unclear if measurement alone is enough to actually reduce carbon emissions or other environmental and social impacts. In Part II, I examine organizing campaigns and coalitions, in historical and contemporary contexts both inside and outside of the tech industry, that seek to connect labor rights to environmental justice concerns. Part I takes stock of the problem and Part II offers some potential steps toward solutions.

Assessing Impact: Carbon and Beyond

New waves of legislation are scrambling to address the various potential effects of powerful LLMs. Stanford researchers assessed foundation models according to a range of criteria set forth by the European Union's AI Act draft, including energy, compute, risks and mitigations, and data governance. In their Artificial Intelligence Risk Management framework, published in January 2023, and in their newly launched Trustworthy and Responsible AI Reference Center, the National Institute of Standards and Technology references the environmental impact of AI: "AI technologies, however, also pose risks that can negatively impact individuals, groups, organizations, communities, society, the environment, and the planet." Despite these developments, more robust connections between environmental and social harms, and labor rights in particular, are sorely needed.

Researchers within technology companies and in academia are also finding new ways of calculating the environmental toll of AI. Some technologists call for the development of a greener machine learning focused on energy efficiency, benchmarking tools, and carbon reporting. In a co-authored paper, Sasha Luccioni of the AI startup Hugging Face has advocated for life cycle analysis, considering embodied emissions tied to the manufacturing of the equipment needed to produce and train AI in addition to the machine learning training itself, adding the emissions tied to deployment and use to those involved with disposal. Researchers at the University of California Riverside and the University of Texas Arlington have written a paper examining the water footprint of AI. In an interview, lead researcher Shaolei Ren emphasizes that carbon efficient and water efficient times of day might be at odds, so developers must consider the effects of scheduling their model training for specific times of the day or in particular locations and carefully weigh their options. It is crucial to consider carbon emissions in tandem with other environmental factors, including water use, and social repercussions.

Undersea cable to St. Martin's © Andrew Abbott (cc-by-sa/2.0)

In their famous “Stochastic Parrots" paper, researchers Emily Bender, Timnit Gebru, Angelina McMillan-Major, and Margaret Mitchell examine the environmental and ethical issues associated with ever-larger language models. Most cloud compute energy sources are not from renewable energy sources, and even renewable energy has an environmental toll because of the rest of the supply chain and the life cycle of AI development. Bender et al. explicitly connect the environmental impact of machine learning to some of its other ethical implications, including its contribution to perpetuating inequalities, inadvertently harming LGBTQ and Black people based on filtering mechanisms, and advancing harmful ideologies. Large datasets do not guarantee diversity. People also attribute communicative intent to LLMs, even though they are not humans and do not have consciousness. LLMs tend to benefit those who already have the most power and privilege. As they argue, “It is past time for researchers to prioritize energy efficiency and cost to reduce negative environmental impact

and inequitable access to resources — both of which disproportionately affect people who are already in marginalized positions."

It is noteworthy that Mitchell, the founder of the AI ethics team at Google, and Gebru, a renowned Black woman researcher on the same AI ethics team, were fired from Google because of the company's discomfort with the paper's arguments. While companies espouse values about DEI (diversity, equity, and inclusion), ethics, and sustainability, workers with these expertise and sometimes entire dedicated teams are often some of the first to be impacted by layoffs. As Sanna Ali et al. argue in their 2023 FAccT paper, if there is a lack of institutional support for AI ethics initiatives, then the burden falls on individuals to advocate for their work. At every step, ethics workers are inhibited by a company's focus on product innovation, quantitative metrics, and perpetual reorgs that disrupt workflows and relationships.

In tech circles and climate pledges, there is a tendency to focus on calculating, measuring, and reporting GHG emissions at the expense of other factors. There is a problem with fetishizing carbon, particularly when carbon offsets are another point of financialization and exploitation, such as when carbon offsets are used to justify colonialism in the Amazon in the name of regenerative finance. STS scholars Anne Pasek, Hunter Vaughan, and Nicole Starosielski thus call for a more relational approach to thinking about the carbon footprint of the ICT industry: "Rather than seeking to evaluate sectoral performance as a whole, and thus overcome vast data frictions in assessments at a global scale, relational footprinting identifies specific differences between discrete and measurable local elements and suggests how these differences might be leveraged for climate mitigation." They advocate for a "reorganization of global infrastructures in order to leverage regional energy differences." Too often, for tech companies, searching for the perfect data, or the act of measurement itself, is the end of the story.

There are many differing ways of measuring the carbon impact of various technologies, including AI. But that doesn't necessarily take into account global differences and, even moreso, the downstream effects on marginalized communities. Some researchers, including Bogdana Rakova, Megan Ma, and Renee Shelby, are attempting to reconceptualize AI as ecologies, imagining a more transparent form of algorithmic accountability based on feminist principles and solidarity. Rakova calls for a feminist disruption of AI production, focusing on the power of speculative frictions: rather than thinking of humans as sources of friction in automated systems that should be made invisible or rendered obsolete, Rakova urges AI practitioners to take up a more cautious form of technological production, drawing on a Mozilla Festival workshop that included diverse voices in thinking about how AI might intervene in environmental justice problems and what it would mean for humans and ecosystems to intentionally slow down AI production through friction.

Standard Oil Company Fire at Greenpoint, Brooklyn, 1919. (Wikimedia Commons)

Workflows and Hierarchies in AI Production

Aside from global power asymmetries, there are clear power differentials between corporate leaders and rank-and-file developers within major tech companies, and this creates a disconnect between corporate sustainability initiatives and workplace climate activism.

Corporate net zero goals are built on speculative, and often empty, promises. Most companies are failing to meet their targets and would have to redouble their emissions reductions efforts to be carbon negative by 2030. At COP27, U.N experts released a report proposing new standards to counteract corporate greenwashing. Carbon offsets are essentially scams, another example of a technologically-driven solution to a social problem; a mere 4% of carbon offsets actually remove CO2 from the atmosphere. In some cases, carbon offsets actively harm marginalized people and endangered species in parts of the world that are already facing catastrophic climate impacts.

Some technologists hope to use innovation to decarbonize the industry, as corporate responsibility staff, IT managers, and engineers attempt to measure, report, and reduce carbon emissions across the global supply chain. When it comes to high-energy workloads like machine learning, making emissions legible through telemetry is especially crucial. Developers and managers cannot make informed decisions without data. Carbon aware software helps AI developers understand the relationship between their workflows and the energy grid, letting them know if there is an optimal time of day to train their models depending on where they are geographically situated. But, aside from the developer's

relationship to time and place, power differentials also influence their decisions, as managers and C-suite members might have other priorities, including cost, performance, and shipping a product as quickly as possible.

Technologists have found ways of mitigating the carbon cost of machine learning training. Carbon intensity is a major factor. Part of why Hugging Face's BLOOM model has a smaller carbon footprint than GPT-3 and other models is the lower carbon intensity of the energy source used for training, which means selecting energy source locations according to the availability of renewables and choosing to train models at optimal times of day. Batch scheduling involves getting developers to choose times of day and locations that are optimal according to when the grid has more renewables available. But developers don't always have control over these conditions. They are often pressed for time and face other workplace pressures. They might have managers who do not prioritize these assessments. At the same time, examining these decision-making processes in corporate labs provides insight into relationships between IT infrastructure, power differentials and workplace hierarchies, and internal workflows. Carbon awareness is in some ways an entry point to STS-informed, ecological approaches that go beyond footprinting or meeting net zero goals.

At most companies, management's focus is on product development and prototyping, not on downstream effects. It's hard enough to get C-level buy-in for thinking about the developer, the most obvious human-in-the-loop from their perspective, let alone the generic end user, and forget about anyone or anything outside of that narrow definition of human-computer interaction.

There are issues with only viewing one small part of the AI life cycle. What about the mining and other forms of labor that go into manufacturing and production, or the winding down of AI systems and associated e-waste? The true impact of AI production and use is connected to the larger supply chains, and the poor working conditions, of the entire ICT industry: from the cobalt miners in the Democratic Republic of Congo and Foxconn manufacturing workers in China to e-waste labor and caste politics in India. Ada Lovelace Institute has put out a primer on AI supply chains, including policy recommendations for addressing the thorny problems of accountability in foundation model supply chains and gaps between open source and proprietary models.

Such complications also impact internal workplace practices. As David Gray Widder and Dawn Nafus observe in their paper about AI ethics and the supply chain, a convoluted global supply chain can cloud developers' sense of agency, and thus their sense of responsibility. Ethics checklists aren't necessarily effective when software practitioners feel that they have little control over certain elements of their work: "Obligations and dependencies also look different depending on whether one is looking upstream or down, and it is crucial to recognize these social locations when creating deeper expectations of responsibility. We show below that this social reality has created conditions where interventions fall through the cracks between actors, and has defined other chains of relations (business, personal reputations, user experience, etc.) as secondary or out of scope." And when company leadership espouses AI ethics as a core belief, some developers question if this is a form of ethics washing, wondering if their actions indeed back up their claims. Widder and Nafus also point to hierarchies within AI labor, as developers distinguished between paperwork and more prestigious forms of work.

AI and labor/climate ecologies

As AI is integrated into more and more existing infrastructures, the question becomes: do we really need AI for that? What are companies building and why? Who is it for? Beyond the end user, who are the other networks of people, environments, ecosystems, that are going to be affected up and down the supply chain and through its associated labor practices?

Some might question the wisdom of producing energy-intensive chatbots at a time when climate action is desperately needed: generative AI seems especially pernicious because aside from its carbon cost and over environmental and labor impacts, it is a distraction from the very real existential threat of climate change. Concerns over the existential threat of AI also eclipse attention that should go to climate matters. Geoffrey Hinton, a supposed 'godfather of AI' who recently resigned his position at Google, has stated that AI "might end up being more urgent" than the risk of climate change and that climate change is an easier problem to solve. Such arguments can be used to put more financial resources, and tech press and regulatory attention, towards AI rather than taking necessary steps in mitigating climate change.

There is a general problem with the disconnect between corporate responsibility, and discourses about circularity or sustainability, and actual corporate models of production and the realities of endless growth. Just a handful of multinational companies have all of the power. They own and run the cloud. Power structures in corporate AI development determine who has access to the compute needed to develop, train, and deploy these technologies.

Too often, greenness is bracketed off from other justice concerns and from historically derived, colonialist power structures. Carbon accounting and AI monitoring in various climate contexts or the analysis of open source climate-related data doesn't translate into action unless there is power behind it. **Does AI transparency help if there is no one empowered to change workflows and systems?**

There is not a singular technical solution to a social problem. AI will not solve climate change. Tooling in general won't solve it, either. So what can rank-and-file workers within major companies do to push for more holistic, social justice-oriented interpretations of sustainability in their workplaces and communities? Part II will attempt to answer this question.

Labor Organizing and Environmental Justice in Tech, Past and Present

Lucas Aerospace Workers Road-Rail Bus, Bishops Lydeard (1980)

In the second half of this report, I examine organizing campaigns and coalitions—in historical and contemporary contexts both inside and outside of the tech industry—that seek to connect labor rights to environmental justice goals. This section goes beyond automation and deskilling concerns connected to AI to consider impacts related to the larger tech industry and associated sectors. Labor organizers are grappling with the rapid rise of generative AI and its effects on creative platform labor around the world. In some cases, cross supply chain solidarity combines stakeholders from the environmental justice movement and worker-led grassroots organizations.

Despite the techno-solutionism and greenwashing of corporate net zero calculations, some employee-led groups are pushing their employers to adhere to more forceful climate pledges and are joining forces with community groups and activists. Looking to historical examples offers some potential inspiration to tech workers who might want to participate in collective action today, especially because the high turnover rate and future-oriented focus of the tech industry makes it difficult to retain even short-term historical and institutional knowledge.

Net zero origins: ESG and ERGs

Climate is a place where justice and solutionism collide, especially in this present, critical moment of climate chaos, anxieties over failures to reach corporate climate targets, and the rapid growth of climate tech through venture capital investments. From carbon removal to using AI to track and mitigate climate change, there seems to be an ever-growing array of technical solutions to the climate crisis. And as many critics have pointed out, carbon accounting processes and promises of "low carbon oil" are a means of stalling, or as Helen A. Hayes and Janna Frenzel argue a strategy of delay, often obscuring extractive practices and avoiding the abolition of fossil fuels.

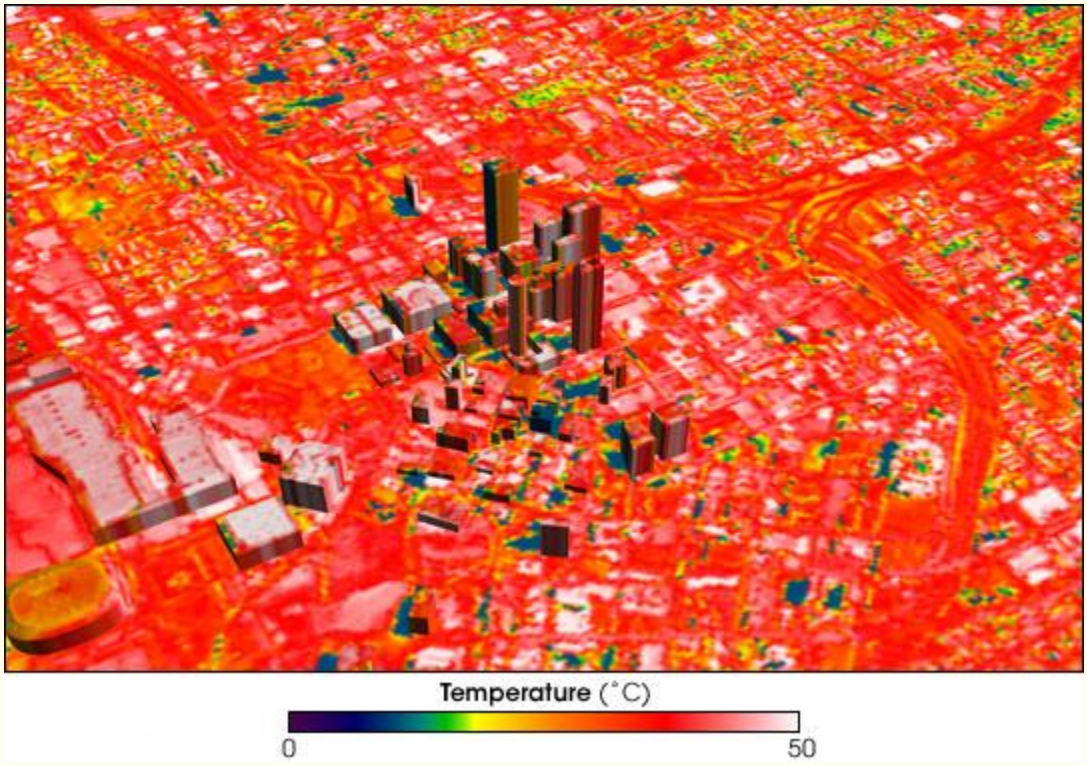
There are tensions between marketing, corporate responsibility, or potential greenwashing and what some workers within corporate tech environments are doing to actively mitigate climate change. Some stakeholders within companies prioritize technical solutions, like software for measuring and reporting carbon emissions, and new open source tools that will allow the industry to reduce its emissions. And emissions are certainly rising with high-energy workloads, including generative AI. But there are also individuals and groups within corporate tech settings who are advocating for climate justice approaches to the overall problem, and who are taking a more holistic view of sustainability. In some cases, workers within tech companies are also connecting labor rights to climate-related goals. Here, I'm interested in the incompatibilities and inconsistencies, and points of friction, in these worldviews and practices. What forms of collective action are possible and effective under these circumstances?

ESG, or environmental, social, and governance disclosure compliance at companies, emerged in the 1960s. This marked a moment when investors became more concerned with social responsibility, intervening in movements for anti-Apartheid divestment from South Africa, although the term ESG first appeared in a 2004 U.N. report. ESG reporting has been a growing trend, with 96% of S&P 500 companies releasing reports in 2022, now that the EU and many US states require companies to release annual reports with statistics related to U.N. Sustainable Development Goals. In some cases, ESG is a point of interest for investors and shareholders who are concerned about sustainable and responsible technology. Generative AI raises questions for ESG-focused investors, who are paying close attention to how companies are using and investing in new technologies. ESG regulatory guidelines regarding AI are less stringent in the U.S. than in Europe or in Asia, so it's unclear how responsible some companies' actions are.

Many major companies, including tech giants like Amazon, HP, Intel, Microsoft, Google, and Salesforce, have made pledges around net zero or net negative. Salesforce's Super Bowl ad campaign featured Matthew McConaughey, the actor, dressed as an astronaut. The ad was a play on billionaire space exit, a dig at Jeff Bezos, Elon Musk, and others who dream of leaving the earth for greener pastures. According to Salesforce, the "new frontier" is a more sustainable, and habitable, planet earth. Salesforce also laid off over 8,000 employees in early 2023 while paying McConaughey $10 million for his role as a "creative advisor." Slick sustainability branding can gloss over other ethical concerns.

2030 is a popular target year in these goals in part because of the UN's 17 Sustainable Development Goals, released in 2015, which strive to meet socially responsible and sustainable targets around the world, including gender equality, affordable and clean energy, and responsible consumption and

production. 2050 is another popular target year for net zero because of the UN's 2015 Paris Agreement.



On May 11-12, 1997, NASA collected thermal data on Atlanta, Georgia. The city saw daytime air temperatures of only about 26.7 degrees Celsius (80 degrees Fahrenheit), but some of its surface temperatures soared to 47.8 degrees Celsius (118 degrees Fahrenheit). Image courtesy NASA/Goddard Space Flight Center Scientific Visualization Studio.

Employee resource groups (ERGs), which are employee-led affinity groups within organizations, also originated in the 1960s. ERGs were primarily created for workers from specific racial groups. Many companies have identity-based groups for LGBTQIA+, disabled, Black, Latinx, Jewish, and women employees, with some affinity groups for employees who are passionate about the environment or other causes. According to McKinsey, ERGs help foster DEI (diversity, equity, and inclusion) initiatives and help with employee retention and well-being (and, by extension, productivity). However, even if ERGs can offer spaces for important, critical conversations, as I found in my own experience as part of Intel's Out and Ally Leadership Council for LGBTQIA employees, where members offered learning sessions while having conversations about navigating the company's healthcare benefits, these groups are led by volunteers and do not always have executive-level support or funding. As a former Airbnb employee wrote in his post for the Tech Workers Coalition's newsletter, while he threw himself into employee resource group activities as a way of connecting with a community of Airbnb workers and to change the company culture from within, he soon found that such initiatives relied on unpaid labor and were especially time-consuming for Black women employees. As he puts it, "I couldn't fathom the drain from microaggressions, code switching, and gatekeeping, which cut across the product orgs, too." While the ERG provided a space for having more critical conversations about disparities between different

groups of workers, management ultimately had the power to lay off members of the "Airfam," or what Airbnb refers to its employees.

Employee Resource Groups and other DEI initiatives are enfolded back into the corporate structure. They are decidedly not unions and some might argue that they are intended to prevent workers from forming unions in the first place. Based on a culture of volunteerism, they often involve extra work for people who are already dealing with working in a racist, sexist, homophobic, or otherwise hostile environment. And without C-suite support, DEI initiatives often fall flat. You can put all of the recommendations in place that you want, but unless someone with power is backing the plan, nothing will materially change.

These limitations aside, some climate-related ERGs at major tech companies, including Microsoft, Amazon, and Mozilla, have been successful in pressuring companies to make and adhere to climate pledges. The Microsoft Sustainability Community, which has over 5,000 members around the world, was co-founded by two Microsoft employees in 2018, developed the tagline "make sustainability part of everyone's job." There is the potential for creating space for climate justice through ERGs. Workers may start with a reading group and maybe it becomes something bigger, through having conversations about abolition, racial justice, and labor protections. What will that look like now, with the ever-present threat of mass layoffs? As I will describe below, in some cases, such groups have formed coalitions and pushed for broader labor rights and climate and environmental justice causes. Looking to some historical examples helps to pivot away from corporate responsibility and regulation to focus attention on worker-led, coalition-driven campaigns.

The Lucas Plan: Lessons for a Just Transition

In the 1970s in the United Kingdom, manufacturing workers at Lucas Aerospace were threatened with layoffs. In response, shop floor workers came up with a plan to produce what they dubbed socially useful goods, which would help the company shift away from producing fighter aircraft components. They created a 200+ page plan including 150 product concepts, such as wind turbines and a battery-driven car, pointing to sustainable technologies that might be used for the social good as opposed to militarism, enacting a worker-led form of radical R&D.

As Dave King argues in an article for Science for the People, "the Lucas workers' understanding of the politics of technology, is important to help understand current debates about automation. Their critique of Taylorism, and their positive philosophy of human-centered technology, is a necessary corrective to the so-called materialist politics of the left, which is often extremely naive about the actual material realities of production— something the Lucas workers experienced directly. Even when automation does not outright destroy jobs, substitution of human skills with machinery inevitably produces a system that alienates workers and gives them less power and control over production." While the Lucas Plan was not officially successful, in that the plan was never implemented, it has wide-ranging influence. Lucas workers spread their ideas through teach-ins and academic collaborations, inspiring similar actions by workers in other countries.

Socially useful production is in many respects a preamble to "responsible technology" and AI, or to calls for a Just Transition, an approach developed by environmental justice groups and labor unions rooted in working-class BIPOC communities. The Lucas Plan is especially poignant when thinking about the

effects of automation and mass layoffs on jobs in the tech sector and beyond. Just Transition advocates eschew carbon-focused approaches to the climate crisis, especially the carbon trading market, instead emphasizing the need for redistributing power and resources while building to meet current community needs. There is a dire need for more coalitions across environmental justice and climate justice and digital rights organizations.

Green technologies from within Big Tech can be extractive, as opposed to measures that further justice. There are often power imbalances in green solutions from the Global North versus the majority world. As Becky Kazansky describes in a report for The Engine Room: "Environmental and climate justice practitioners we spoke to pointed to power imbalances, saying that global north state actors have a 'do as I say, not as I do' attitude: pushing countries in Africa to mitigate their contribution to climate change even as they don't do enough themselves. In one example that was raised, while African nations were told not to explore their natural gas reserves during the recently concluded COP26 meetings, the EU is the biggest importer of gas from Africa, which means that existing gas resources are not available for Africans themselves." As Kazansky also highlights, introducing AI into agriculture in places like China with the intended purpose of reducing carbon emissions can have unforeseen effects: "The use of AI and automation in mining, for example, makes the work more energy efficient but also displaces workers."

How might we better address environmental and climate justice in tandem with labor repercussions?

Silicon Valley Toxics Coalition: Environmental Justice and Immigrant Labor

Other coalition-based environmental and climate justice and labor rights interconnected movements from the past also offer a way forward.

There is a long history of coalition-based organizing in Silicon Valley, with overlap between groups working on immigrants' rights, labor rights, and environmental justice. As described in David Neguib Pellow and Lisa Sun-Parks' The Silicon Valley of Dreams, events like Fairchild Semiconductor contaminating the drinking water of South San Jose with the chemical trichloroethane, which is used to remove grease from microchips after manufacturing, catalyzed community organizing, including the formation of the Silicon Valley Toxics Coalition. The toxic chemicals used in electronics manufacturing caused cancer in immigrant women workers and birth defects in their children. As Pellow and Sun-Parks note, Moore's Law has a direct implication for the toxicity of chip manufacturing: the smaller and more powerful the chip, the more toxic it is. This seems especially pressing when more powerful chips are needed to support the production of generative AI.

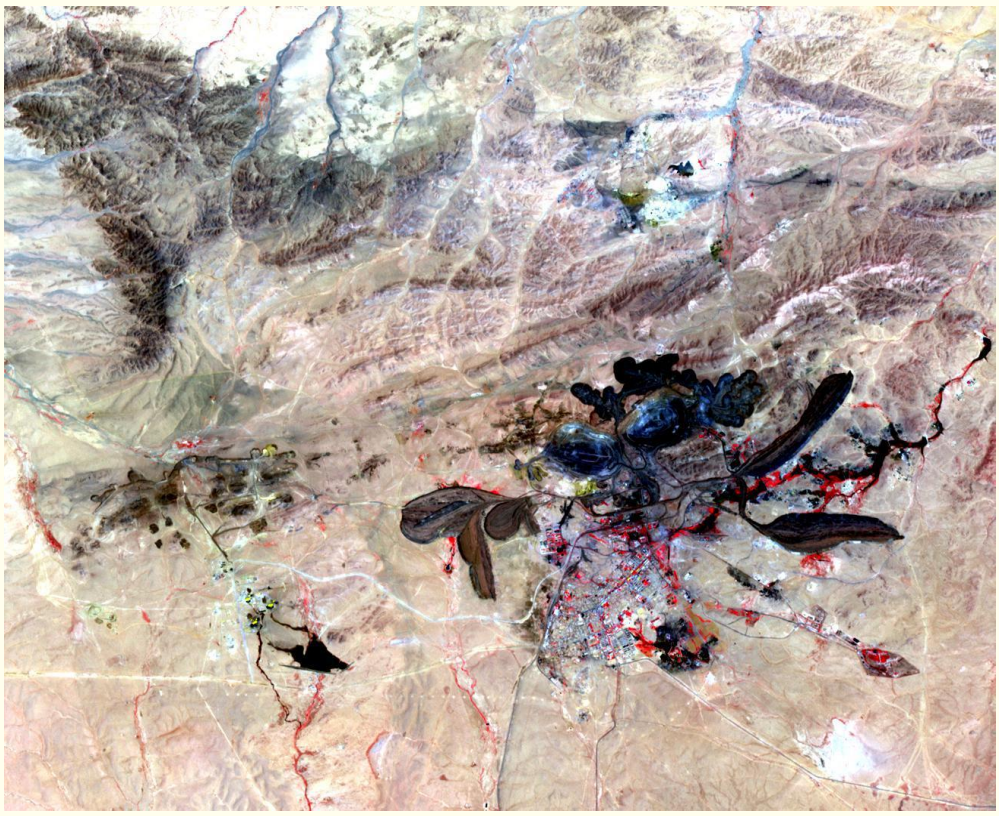
Fascinatingly, the SCTV's 1996 Campaign for Responsible Technology put forth Silicon Principles that are still highly relevant today, including advocating for a toxics use reduction program, health and safety education, working with local communities and workers, economic impact assessments, R&D policy for civilian and not military needs, global corporate standards, and a life cycle approach.

The SVTC contains lessons for the contemporary climate tech movement. It is crucial to learn from activists who are already doing the work rather than attempting to find solutions with tech alone. Tech workers need to include marginalized communities from the start and change how production happens.

Coalitions like the Center for Interdisciplinary Environmental Justice combine academic, artistic, and activist approaches to environmental justice. CIEJ, an Indigenous-led organization, advocates for decolonial feminist science and published an anti-greenwashing educational toolkit.

There is a dire need to center other forms of expertise. Not just the technical knowledge of engineers, but those in civil society, academia, activism, and community groups. How do you incorporate other forms of knowledge into technological frameworks without being extractive? Theodora Dryer testified at the European Commission, which asked her how AI could be deployed to help with the energy transition while avoiding hampering decarbonization goals. As Dryer puts it, "Algorithmic systems function within larger 'computing landscapes' that encompass particular power structures, environmental conditions, and policy contexts." As an example, Dryer points to the ways that the disavowal of Native American water rights in the United States is embedded in state-run automatic systems.

Decarbonization as a goal in and of itself cannot rely solely on the tech industry and consumers to drive rapid and systemic change. Industry partners must listen to communities about their needs rather than making a priori assumptions. It is crucial for technologists to consider the full social implications of the technologies they build and for 'tech for good' to derive from the experiences of the communities they are in theory trying to help.



The mine in Baiyun Ebo, Inner Mongolia, China, which is the site of almost half the world's rare earth element production. Image taken by NASA. The image covers an area of 15 × 19 km.

Cross-Supply Chain Solidarity

Returning to the previous section on ERGs and internal movements at major tech companies or across the industry, what happens when such organizations combine forces with broader coalitions of activists? Is there potential for ERGs and other employee-led groups or cross-industry orgs like Climate Action Tech, another international affinity group and Slack community for sustainability-minded technologists, to spur more political action? And what are the limits of relying on internal, worker-led pressures? How does power operate within the enterprise and across the industry?

There is a wealth of academic research and investigative reporting on the gendered, racialized, globally dispersed labor behind AI. But it is just as important to look at how workers organize and strategize around a changing technological landscape. Researchers from the Distributed AI Research (DAIR) Institute, Adrienne Williams, Milagros Micelli, and Timnit Gebru, write about the workers behind AI, including the globalized, precarious annotators and data labelers who perform work for Amazon Mechanical Turk. They point to the need for tools that help workers find each other and correct for power asymmetries between them and platform managers and requesters. They also call for more transnational, cross-collar solidarity across the entire supply chain.

One example they raise is that of Emily Cunningham and Maren Costa, two UX designers at Amazon who co-founded Amazon Employees for Climate Justice. More privileged white collar workers can support, and find camaraderie with, more precarious workers across the enterprise. Over 8,000 Amazon workers signed an open letter in 2019. Addressed to Jeff Bezos and the board of directors, the letter demanded immediate climate action. In response, Amazon created a Climate Pledge, promising to reach net zero by 2040. AECJ aligned with other racial, environmental, and climate justice groups, tying Amazon's emissions to harmful effects on communities of color and joining the youth-led Global Climate Walkout. But as Williams, Micelli, and Gebru describe, it was not necessarily the group's environmental activism that attracted their employer's ire: "Cunningham and Costa say they were both disciplined and threatened with termination after the climate strike — but it wasn't until AECJ organized actions to foster solidarity with low-wage workers that they were actually fired." Companies may be willing to indulge employees who push for climate actions that may also work to the company's benefit in terms of consumer appeal. But labor-based solidarity in a climate context is a threat to their bottom line.

More recently, AECJ has demanded for climate reparations for devastating flooding in Pakistan, asking Amazon to pay for its role in climate change. AECJ is directly linking catastrophic climate change and its effects on the Global South to the struggle of Pakistani workers on H1B visas, addressing labor precarity alongside climate justice.

Sociologist Nantina Vgontzas advocates for examining Amazon's environmental harms across the supply chain. Vgontzas points to the need for movements that consider both larger, global regulatory measures alongside local concerns. Degrowth can be seen as a strategy, even as a part of worker praxis: "But degrowth could also be viewed from the lens of shopfloor micropower. In the case of Amazon, curtailing network growth would mean curtailing both the surveillance tools that have eroded worker autonomy as well as the network redundancies that have eroded worker capacity to disrupt operations through strikes and other actions. In foregrounding the goal of bolstering worker power as a

means of mitigating corporate harms, a degrowth framework could allow for a range of strategic options that would slow down the trend of data collection, surveillance, and network redundancy." This variety of transnational, worker-led interpretations of climate justice offers a way forward.

Beyond Techno-Solutionism

While regulatory pressures and climate disasters put pressure on corporations to measure, report, and reduce their GHG emissions, an outsized focus on carbon footprinting and technical solutions tends to leave out technology's more complex social impacts. It is crucial that tech companies assess their impacts across the supply chain and across the development lifecycle, especially when it comes to new powerful technologies such as generative AI. Climate and labor impacts must be examined in relation to each other.

There are historical examples of rank-and-file tech workers organizing in solidarity with environmental and climate justice and other grassroots advocacy groups as well as with labor unions. Even as net zero pledges evade addressing the most pressing aspects of capitalist production and fossil fuel dependency, there are ordinary workers within tech companies who need more regulatory pressures and activist support to help transform internal workflows, hierarchies, and the culture of tech company workplaces.

In general, my recommendations for moving past techno-solutionism in climate, labor, and AI include:

- Centering bottom-up, employee-led movements
- Fostering connections to the labor movement and cross-collar, full supply chain solidarity
- Centering grassroots organizing and expertise from outside of tech, policy, or academia
- Looking at end-to-end and lifecycle sustainability rather than at individual parts of software development
- Starting with the Global South as a point of analysis and frame of reference